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Individual Behavior in Complex Choice Situations

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Publication date:
2019

Document Version
Publisher's PDF, also known as Version of record

Link to publication in Tilburg University Research Portal

Citation for published version (APA):
Klein, T. (2019). *Individual Behavior in Complex Choice Situations*. Tilburg University.

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Individual behavior in complex choice situations

Inaugural address delivered by

Prof. Dr. Tobias J. Klein

Tilburg University

Understanding Society

Tobias Klein (Stuttgart, 1979) is Professor of Econometrics at Tilburg University. He studied economics at the University of Mannheim, the University of California at Berkeley, and University College London. He joined Tilburg University's School of Economics and Management in 2007 after obtaining a Ph.D. from the University of Mannheim. He is deputy managing editor of the Econometrics Journal, associate editor of Empirical Economics and the Review of Economics, and was editor of a special issue of Information Economics and Policy on current regulatory issues in media and entertainment markets. Over the past 12 years Tobias Klein has been acting as an advisor and (co-)promotor for 12 Ph.D. students.

Klein's research is in health economics, empirical industrial organization, and econometrics. Among other things he currently works on the design of health insurance, the effects of patient cost sharing, consumer behavior, the effects of advertising, competition between online platforms, two-sided markets, and rating systems in online markets.

Tobias Klein's research typically has a methodological component and is more broadly related to the idea that recent developments in information and communication technologies together with the availability of big data can help us to address research questions in a novel way if we combine data with tractable models of individual behavior. Insights gained in this way often gives rise to the opportunity to implement welfare-improving policies that are at the same time in the interest of the firms offering a service. This can even lead to the creation of new markets. Examples are the online rating mechanisms used by eBay, Airbnb, Tripadvisor, Yelp, Uber and others, which discipline market participants via online ratings that lead to more transparency. Another example is well-targeted advertising that reminds consumers to make a purchase if they intended to do so. In health economics, he develops methods that can be used to improve patient cost-sharing systems.

Tobias Klein teaches econometrics in the BSc Data Science and in CentER's Research Master in Economics.

Individual behavior in complex choice situations

Prof. Dr. Tobias J. Klein

Inaugural address,
delivered on 6 September 2019 at Tilburg University.

Individual behavior in complex choice situations

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ISBN: 978-94-6167-398-5

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Prologue

Thank you all for coming.

It is a great privilege to be an academic and I'm honored to deliver this inaugural address. In the next 45 minutes, I will take you on a little journey. I will talk about some of my research, econometrics more generally, and why I believe it's more exciting than ever to be an applied empirical researcher.

Introduction

Life is complicated. We have to continuously make decisions. Some of these decisions are easy ones and routines help us to choose what to wear, what to have for breakfast, how to get to work, and how to organize a normal day, to name just a few examples.

Other decisions are more complex. Should I buy a house now, or should I wait? Which house? How much should I bid for it? How much should I save? How should I invest my money? Should I look for another job? Should I move somewhere else? Which school is best for my kids? Which new TV should I buy?

These decisions are complex because of uncertainty, a lack of information, and because it's highly personal whether a decision is actually a good one or a bad one. And life is complicated because we have to make many decisions, face time constraints, cognitive constraints, and because some of these decisions are intertwined.

So, we generally look at things in isolation, resort to heuristics, copy decisions of others, rely on intuition, or simply don't make a decision. But of course this is also a decision.

One can study individual decision making for many reasons. I am an economist by training and my main motivation is that in the end of the day economists are in the business of helping policy makers to design better institutions. In my view, this should be based on evidence. Econometrics is the part of economics that develops the tools and empirical approaches that can be used to actually provide such evidence. In the following, I will illustrate this with some examples.[1]

[1] The aim of this inaugural address is not to provide a systematic review of the literature. There are a number of excellent reviews of the literature in household finance, behavioral health economics, rational inattention, behavioral economics, and other areas of economics. References to some of those are provided in the three papers that I discuss in more detail below.

Health insurance in Peru

I'm pretty sure that everyone in this room has health insurance. This is a great achievement of modern society, but we should of course not forget that we are blessed to live in the First World. Health insurance protects us against financial risks and gives us access to a system of health care providers. But are there additional benefits? Especially when life is complicated and when we do not always make perfect decisions?

A few years ago, together with my former student Noelia Bernal and our co-author Miguel Angel Carpio I studied this question for Peru (Bernal et al., 2017). Peru provides an interesting setting for this, because there was actually a substantial fraction of the population that did not have health insurance. Only from the early 2000's onwards, the government provided health insurance to poor individuals without a formal job.

One of the main themes in econometrics is the one of "endogeneity" and many who have never studied economics or econometrics are familiar with the statement "correlation is not causation". Here, this means that one cannot simply compare individuals who have health insurance to individuals who do not have health insurance. These two groups are different in many ways. For instance, those with health insurance may be better educated and earn higher incomes, and may be healthier for that reason. So what we did in this paper was to zoom in and made use of an institutional detail: individuals were covered by health insurance when an index that was computed by the government were lower than a threshold value. We re-computed the index for a sample of individuals and compared individuals who were just eligible for free public health insurance to individuals who were just not eligible.

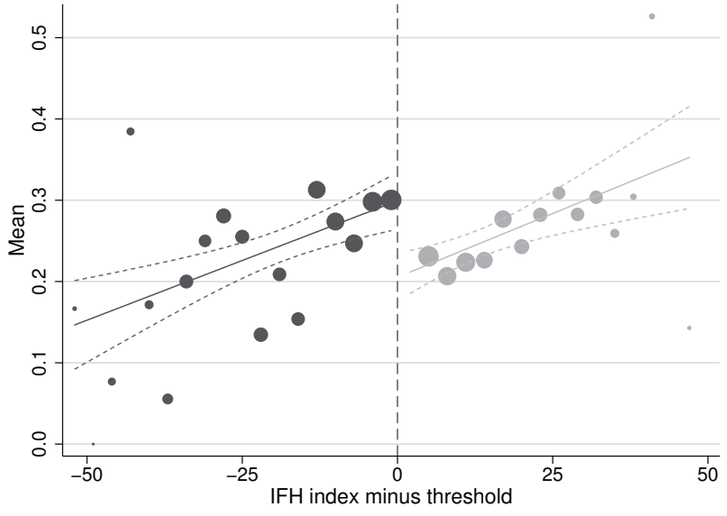

Figure 1: the effect of health insurance on curative care consumption in Peru

> *Note: Taken from Bernal et al. (2017). The figure shows the probability to receive curative care plotted against the index that is used to determine eligibility for public health insurance. Lower values of the index are associated with lower incomes and less wealth. Individuals are eligible if the index is negative.*

And one sees what one would expect: those who are eligible for free health insurance are covered for at least some treatments, as compared to no coverage, and therefore we should observe what we would call a price effect in economics: health care utilization increases. Figure 1 shows exactly this: the probability to receive curative care is higher when individuals are just eligible, that is have a value of the index just below zero, as compared to individuals who are just not eligible, that is have a value of the index just above zero.

Notice that the figure shows at the same time that there is a positive trend: individuals with higher values of the index receive more curative care. At this point, we can only speculate why that is. However, the main take away from the paper, which I'm going to talk about now, relates to this observation.

The data we used were particularly rich, which allowed us to shed more light on how individuals make decisions. In particular, the data also contained information on the financing source for particular treatments. And when we used that information, what we actually found was that insurance coverage has a positive effect on the probability to be hospitalized or to receive surgery. Interestingly, patients mainly paid for this themselves. And indeed, we find that the effect of insurance coverage on out-of-pocket health care expenditures is positive.

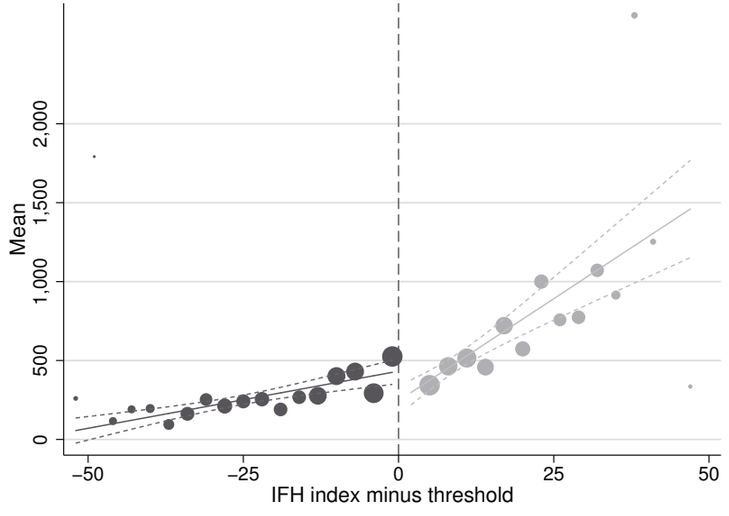

Figure 2: the effect of health insurance on out-of-pocket spending in Peru

> *Note: Taken from Bernal et al. (2017). The figure shows average annual out-of-pocket spending per year in Soles plotted against the index that is used to determine eligibility for public health insurance. Lower values of the index are associated with lower incomes and less wealth. Individuals are eligible if the index is negative.*

To interpret this finding it is useful that I tell you more about the institutional background. In Peru, individuals can go to a pharmacy or health care providers and simply buy medication or treatments. And they do regularly do that. Which means that out-of-pocket health care expenditures are actually not zero when individuals are not covered by health insurance. But what one would probably expect is that they would decrease when individuals become covered by health insurance. Here we observe the opposite: health care expenditures went up. And the explanation we give for this in our paper is that free coverage motivated individuals to see a doctor and as a result they decided to pay themselves for services that were actually not covered.

We found this remarkable, because it shows that we have to think of individuals in much richer ways than what traditional models of demand, where individuals have preferences and react to prices, would presume. In fact, the way we design institutions seems to matter a great deal, even if the economic incentives are more or less the same. Individuals go to a health care center and seek advice when it is free, as compared to a situation when they have to pay a small fee. And individuals actually undertake treatments when they are told to do so, even if they have to pay for those themselves. So, free health insurance could have positive effects even if treatments are not paid for.

One way to think about this is that when life is complicated—poor individuals face many challenges in Peru—and when decisions are complex—what to do when one is poor and is plagued by pain or suffers from an illness—then decisions of individuals depend on many other factors other than economic incentives and in particular what they believe is expected of them. When a free health care system is put in place, then they interpret this as being expected to see a doctor. Without it, they simply go to the pharmacy and buy some drugs.

This means in turn that it would be harmful for policy makers to rely on theories of patient behavior that abstract from all other aspects of life and look at a choice situation in isolation. Econometrics is useful to provide evidence on how individuals actually make decisions, which will then enable policy makers to design better institutions. In the case of Peru it seems that motivating individuals to seek advice from a doctor has positive effects, so policies that promote this have the great potential of being welfare-improving.

The framing of economic incentives

We have just seen that presenting the health care system as accessible, by introducing truly free health insurance with coverage of basic services, can have large effects. Arguably, it should not matter whether something is free or has a small price. But in practice it does seem to matter a lot how individuals perceive details of a choice situation. Maybe a small price signals something to them.

This relates to a large body of work in behavioral economics on framing. Broadly speaking, the finding of that literature is that framing effects can be very important. In particular, presenting the exact same prospect or lottery differently has large effects on individual behavior. One way to think about this is that individuals don't fully understand what they are evaluating. But I was always reluctant to say that this is irrational—after all there could be a cost to evaluating a prospect and it could be rational not to spend too much time or energy thinking about it.

In joint work with Arthur Hayen and Martin Salm I have studied the effects of framing on behavior of Dutch patients in the context of health insurance (Hayen *et al.*, 2019). Most of you will be familiar with the system. These days, there is a deductible in place, which means that for the first 385 euros of care one pays oneself. Some types of care are exempted, for instance GP (general practitioner) care.

Now think about how one should react to the incentives this provides. Ellis (1986) shows what a fully rational patient who does not face liquidity constraints should do: she should not look at whether she still has to pay when going to the doctor, but should instead ask herself whether she expects to pay for the last unit of care received in the year. This involves forming beliefs about care consumption in the future. For this, one needs to think about medical needs and prices. Maybe people will find this too complicated. And indeed, more and more evidence is accumulating that this is not what they do: individuals essentially consume less care when they currently don't have to pay, even when we hold dynamic incentives fixed (Brot-Goldberg et al., 2018).

Arguably, this shows that individuals perceive this as a complex and challenging choice situation. We take this as a starting point and study how they react to policy changes that do not change financial incentives. Luckily, we could make use of the fact that the deductible was introduced in 2008 and replaced

a so-called no-claim refund. The refund worked like this: if one did not consume any care, then after the end of the year one received a certain amount of money back. For any euro of care that was consumed during the year, one received one euro less, until the rebate was zero.

It turns out that this provides very similar incentives as a deductible: up to the cost sharing limit, one euro more health care consumption means one euro less for other consumption. But the presentation is very different: a deductible presents cost sharing incentives as a loss—one has to pay money when one sees the doctor—, whereas a payback rebate presents them in terms of gains—one receives less of a rebate. When individuals react stronger to losses than to gains (Kahneman and Tversky, 1979), then we should see that individuals react stronger to cost sharing incentives when they are framed in terms of a deductible.

And this is exactly what we find. We estimate the effect on monthly spending and then conduct some simulations. We find that yearly health care expenditures are 8.6 percent lower when cost-sharing incentives are framed in terms of deductibles as they currently are.

Whether this is good or bad remains an open question. But some Dutch health insurers have recently offered the option to their clients to pre-pay their deductible, essentially turning it into a no-claim refund. If individuals also perceive it that way, and it's not clear that they will, then this could actually mean that health care costs may increase more than these insurers have anticipated, and this may lead to substantial losses.

So, what our paper shows is that framing effects are quantitatively important in the context of cost sharing in health insurance. We have investigated whether this is driven just by particular groups—one could for example imagine that this is an average effect that is driven by poor individuals—but this is actually not the case. Once more, it seems that complex decisions are influenced greatly by the way in which individuals experience the decision environment.

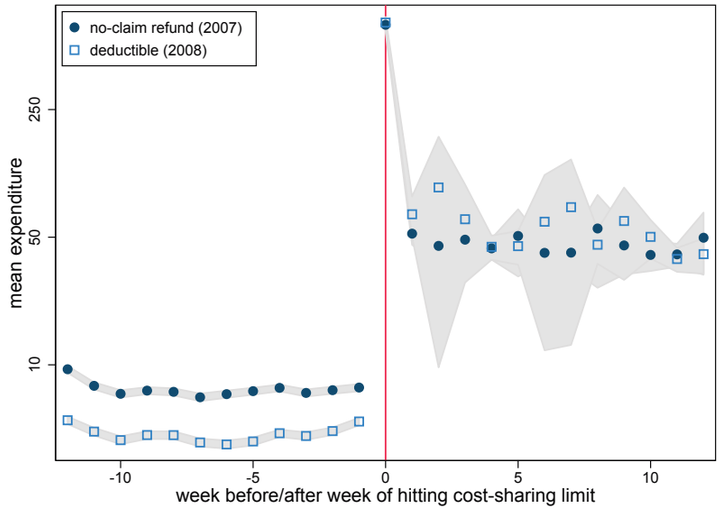

Figure 3: care consumption around week in which cost-sharing ends

Note: Taken from Hayen et al. (2019). Individuals have to pay for medical care until they hit the cost-sharing limit. This figure shows that until then, expenditures are lower. The main point of our paper is to show that not only this financial incentive matters, but also how it is framed. One can see in the figure that expenditures are lower when financial incentives are framed in terms of a deductible.

Advertising as a reminder

We have now seen two examples where a simple model in which individuals choose what they like best does not describe well how they actually make a decision. In the last example, I would like to focus on thinking of choice as a process.

Imagine that you have surfed the internet and you want to buy a product. It would be nice to have it for a particular occasion, let's say it's something to wear for a birthday party. Or a particular power tool to get some work done at home during a long weekend. You have read multiple reviews, looked at some websites to compare prices, and have made up your mind. But you haven't gotten around to ordering it. After all, life is complicated and there are many other things to do. You have decided to do it later.

The event is drawing closer. One evening you are on Facebook and after a while you see an advertisement, reminding you of the product. Obviously, many of us will think of all the reservations that come with this, privacy concerns (see for instance Acquisti *et al.*, 2016, for a survey on the economics of privacy). These are important, but here I would like to focus on a different aspect: this advertisement reminds you of your intended purchase. And when it reaches you in the right moment, you may at last buy the product.

This is a way to think about advertising that is unusual. The literature, by and large, has distinguished between advertising that provides information about the existence and prices of products, which is generally useful to consumers and also leads to more competition, and advertising that changes preferences (Bagwell, 2007).

Empirically, it is challenging to analyze whether there is actually something to the idea that advertising can act as a reminder. But my former student Chen he and I believe that we have found a nice setting in which we can investigate whether advertising acts as a reminder (He and Klein, 2019). We look at a product that is almost 300 years old: a ticket for the Dutch State Lottery. The advantage is that it is extremely well-known, so that unlike in many other situations advertising does only two things: first, it informs individuals about the jackpot size; second, it reminds them to buy a ticket. And it actually does so quite efficiently by stating how many days there are left until the draw.

We use high frequency data on TV and radio advertising and on online sales to estimate advertising effects and show two things that are in line with advertising acting as a reminder. First, advertising effects are strong, but short-lived. Second, they are the bigger the less time there is until the draw, consistent with the idea that consumers want to be reminded late, when their intention to buy is higher.

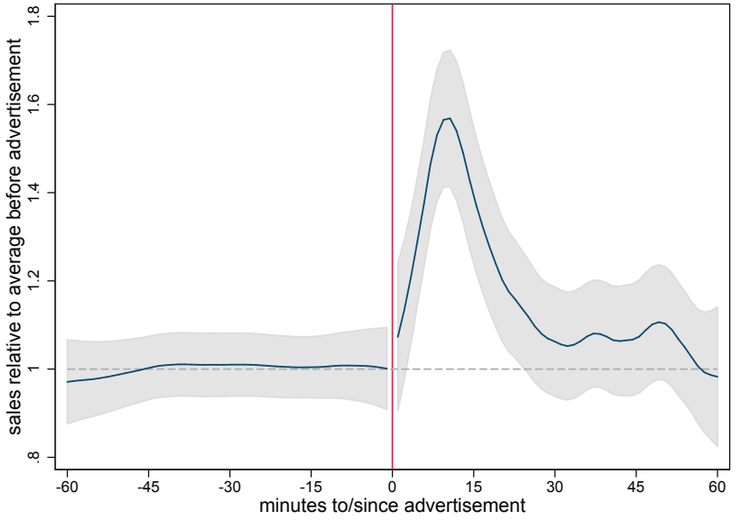

Figure 4: the effect of advertising on sales

Note: Taken from He and Klein (2019).

Then we use a structural model to quantify the overall effects of advertising and find that sales would be 35 percent lower if we turned off all advertising.

You can of course now say that it's probably good when consumers forget to buy a lottery ticket and do something more useful with their money. We don't take a stance on this in our paper, as our main take-away is that we can use our setting to convincingly show that advertising can act as a reminder, and that the effects of this are actually large.

More broadly, what we show is that models of consumer behavior in which consumers can forget to make a purchase can actually be realistic. This may make us think of advertising in a different way, be it for a lottery ticket or some targeted advertising on Facebook. For instance, advertising by the government could remind consumers to consider switching their energy contract or their health insurance, which could lead to more competition and therefore lead to welfare gains.

Econometrics

So now we have seen three examples of complex choice situations. Complexity arises for poor individuals in Peru because they are not very well informed about the consequences of not undergoing treatment and it is difficult for them to learn about this. A small fee prevented them from seeking advice by a doctor. Free health insurance turned that around and led them to actually pay for treatments.

Complexity arises for Dutch patients, as they have to understand the dynamic incentives and form beliefs about future health care consumptions and health care prices. So they seem to take current incentives as a proxy. But then it turns out that they react to current incentives very differently when they are presented in terms of losses instead of smaller gains—a classic framing effect.

And finally, complexity arises when one decision is surrounded by many others and consumers are time- and attention-constrained so that they might forget to do something they intended to do. Then, reminders could help them to remember and actually do it, so they may value them even if they come in the form of an advertisement.

The three examples show that relating individual behavior to details of the choice situation when performing an empirical analysis allows us to better understand why individuals make certain decisions. Ultimately, this enables us to reach richer conclusions and recommendations to policy makers. The econometric challenge is at the same time to pay attention to these details when performing the analysis. For instance, when individuals are prone to forgetting, then a choice model that is estimated should feature an attention stage that determines whether an individual considers buying next to the more classical choice stage. And when choice is about buying now or maybe later, then the choice stage should take into account that tomorrow one may forget to consider buying. A related challenge is to find ways to identify parameters of such a model.

I believe that it is more exciting than ever to do applied empirical work in economics, as richer and richer and more and more data are available that then actually allow us to study choice behavior in more detail.

At the same time, I believe that simply running some machine learning models is not making full use of the potential in the data. In this context I would like to share a quote that I particularly like:

> Statistical information is currently accumulating at an unprecedented rate. But no amount of statistical information, however complete and exact, can by itself explain economic phenomena. If we are not to get lost in the overwhelming, bewildering mass of statistical data that are now becoming available, we need the guidance and help of a powerful theoretical framework. Without this no significant interpretation and coordination of our observations will be possible.

This quote is from Ragnar Frisch's editorial of the first issue of *Econometrica*, in 1933 (Frisch, 1933). I believe the message is still true 86 years later: we need econometrics to make sense of the data.

A lot of progress has been made in econometrics and now a large toolkit is already at the disposal of applied researchers. But at the same time, there is more than enough that we don't know yet, for instance related the analysis of individual behavior in complex choice situations. The aim of today's talk is not to talk about technical details, but in many of the projects I'm involved in there is a methodological side that fits very well to the definition of econometrics that Ragnar Frisch gave in the same editorial. He saw econometrics as the unification of statistics, economic theory, and mathematics—as opposed to the "application of mathematics to economics" or "economic statistics".

What is close to my heart is the applied relevance of what we do in econometrics. It is easy to forget about this when one is enthusiastically generalizing empirical approaches, but I think that it is actually good to always ask oneself whether a generalization of some sort is actually of applied relevance. This is also the reason why I'm very happy to be involved in *The Econometrics Journal*. And to be part of the econometrics department here in Tilburg that, drawing on its many international connections, has a tradition of doing econometrics that is of applied relevance.

Epilogue

This brings me to the final part.

To me, being an academic is the best job in the world. Tilburg University offers a productive and inspiring academic environment and I am proud and honored to be part of it.

I am grateful to many people and there is no way I can name them all. But I would like to single out a few.

I wouldn't stand here today if it wasn't for my parents. That is literally true, but of course that is not what I mean. Antje and Nonnie, the way you brought me up—by creating a loving, caring and stimulating environment, while always being supportive—turned me into what I am today and allows me to be a happy person. I will always be enormously grateful for that. Of course, my brother Sebastian, now with Danielle and Alfie, played also a big role. I really enjoy seeing you all so often, despite the geographical distance between Stuttgart, Dubai and Tilburg.

The next person I would like to mention is my Ph.D. advisor Konrad Stahl. Konrad, you believed in me early on and sent me off to take the first year of the Berkeley economics Ph.D. program to learn from great economists like Daniel McFadden, Paul Ruud, and Matthew Rabin while I was still doing my undergraduate economics degree in Mannheim. You later became my advisor and sent me to UCL to work with Andrew Chesher. And most importantly, we worked together and you taught me to be a good economist, to take a broader perspective and to do solid work on relevant topics. You taught me how to be intrinsically motivated. I am really grateful for that and enjoy to continue to work with you on our joint projects.

I moved to Tilburg in 2007, so 12 years ago, and from the very beginning I have appreciated to work in an environment with great colleagues all across campus. Many have become friends, so the fun extends to evenings and weekends. Also, I feel privileged that I had the chance to work with 12 exceptional Ph.D. students of whom I'm very proud and from whom I've learned a lot. I experience the structural econometrics group as a particularly inspiring and fruitful environment and am particularly grateful to have worked so much with Jaap Abbring, Bart Bronnenberg and Martin Salm over the last years.

Finally, I would like to express my love and gratitude to Jiehui. Founding a family with you and raising our little son Benedikt makes me truly happy.

I have spoken. Ik heb gezegd.

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